ZERO RETRIES

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COAST TO COAST PACKET QSOs & Virtual Circuits

by Budd Churchward WB7FHC

Not too long ago I had a nice QSO with a packeteer in Bocca Ratan, Florida. We were able to exchange several packets and have a pleasant conversaton.

I came home early in the afternoon, about 3:3Ø PDT and checked into the WB7DCH MailBox. Planning to find an east coast station for a chat, I began a process that would connect several stations together across the United States.

Linking stations together in this way ties up a lot of packet real estate, so I wanted to do it as early as possible to get it done before the peak packet hours. I set up what is called a "virtual circuit" from Washington State to Florida.

When you call someone on the telephone, whether it is across your office or across the continent, you are setting up a virtual circuit. The path that your voice will follow is determined by the telephone company's switching equipment. If at any time part of that path fails, you will discover that you have been "disconnected."

Virtual circuits in packet radio are pretty much the same thing. The entire path is set up, mostly by you. If the path fails at any point, retries will catch up with you and you will find yourself "disconnected."

Here is how you can set up a virtual circuit to another part of the country using your own packet station on 2 meters:

1: Connect to your local WØRLI style MailBox/Gateway.

2: Read the "J" list. This is a list of stations that have been recently heard by the bbs. The first column will show the stations that have actually connected to the mailbox and at what times. The second column shows you stations that were "heard" on two meters. The third

HF GateWays

	Call	Location
	N1DL	Sudbury, MA
	KC2TN	Atco, NJ
*	K3VPZ	Granite, MD
	K4AHO	Orlando, FL
	N4CI	Atlanta, GA
*	K4EID	Knoxville, TN
*	KF4JF	Hahira, GA
	K4NTA	Stuart, FL
*	WA4SZK	Florence, SC
	KI4XO	Marietta, GA
*	W5XO	Gause, TX
	W6CUS-1	Richmond, CA
	KD6SQ	Rancho Cucamonga, CA
	WB7DCH	Enumclaw, WA
	K7PYK	Scottsdale, AZ
*	WB8WGA	Gahanna, OH
	KØHOA	Colorado Springs, CO
*	KIØQ	Ames, IA
*	WØRLI	Westford, MA

*can connect with WB7DCH
(table 1)

column shows the times and stations that have been "heard" on hf.

It is this third column that contains the information you will need. Jot down the top three or four calls in the first list and note the times that they were heard. Compare these times with the current time. If no calls have been listed in the last half hour or so, the hf band is probably dead and to proceed any further would probably be a waste of your time. You may notice, however, that some of the times are very recent, within the last minute or two. Check them with calls listed in table 1. You will want to find one that is another hf GateWay.

3: If you are able to find an appropriate call in the "j" list, open the GateWay by sending letter: "G". You will get a new prompt from the MailBox that is much shorter than the one you usually see when you connect.

4: Type C followed by the call of the GateWay you have chosen. For example:

C KF4JF

The line "C KF4JF" will be echoed back to you along with the message: "attempting to connect send ^W to abort."

Your GateWay station will be transmitting connect requests on 20 meters to the station you have selected. You may have to wait longer than you are used to in order to determine if the connection has been made. Remember that on two meters packets are sent at 1200 baud and on hf they are sent at 300 baud.

When the connection is made between the two GateWay stations on hf, the messages: "connection established. ^W to disconnect." and "***linked to KF4JF" will appear on your screen.

5: Wait and watch for the the familiar WØRLI style introduction. There will only be subtle differences in what you see on the screen from the distant MailBox/GateWay and what you are used to seeing locally. The command set will be the same.

6: Wait for the standard prompt to appear with all the alphabet soup, and resend the "G" command. This will allow you to access the distant GateWay to two meters. If you send this command first, you can at least shorten the packets containing the menu prompt that must return on hf.

7: Next send the "J" command. Note, that this time your "J" is being sent to a bbs clear across the country. The list will be in the same format as what we saw earlier, but it may seem to take forever to complete itself. Truly, there is a need for an abbreviated "J" list. You really only want to see the top three or four listings. It would be nice if we could send "J 3" and see only the top three lines, but as it stands now, you will need to wait for 10 lines of data and a prompt to arrive.

Again, there are three sets of data. Study the first two columns this time. Choose a station that has recently been active on two meters. There will usually be several to choose from. If you are lucky, you might even see a notice that someone has attempted to connect to the MailBox while you were receiving the "j" list on hf.

8: Type, as you did before: C followed by the station you wish to connnect with. For example:

C W4xxx

9: Expect the same prompts to arrive from the distant GateWay. If you are lucky you will eventually see that you are "linked" to a packeteer on the east coast.

The MailBox/Gateway software aids us in this process. Everytime a station connects, it records the path (all digipeaters needed to reach it) as well as the SSID number of the user. You don't need to know what digipeaters, or how many for that matter, are required at the other end. It will attempt to connect using the last path

that the other station used to reach it. For this reason, you may find that it is better to chose a call from the "connected" column rather than the "heard" column.

Setting up this virtual circuit is not always easy. You may find that you retry out often, most of the MailBox/Gateway operators have set their retry limits to low numbers in the hopes that will "shake-off" users that have very marginal paths.

You can improve your chances of maintaining the circuit once it has been established by sending short packets. I watch my screen and try to send lines that are only 2Ø to 3Ø characters long. Others might argue that this is a waste of "packet-space" because of the overhead that is added to the shorter packets.

You can get a feel for how much difficulty the hf stations are having, by how quickly consecutive packets are arriving from the other end. If the path is good, increase the length of your packets.

After you have completed your QSO, you can break the link by sending a ^W (CTRL-W). Unfortunately this command brings down the entire circuit.

If you would like to make a second contact through the distant GateWay, you will have to prompt WB7DCH to reconnect. A better move is to get the other guy to disconnect. You are still into the distant GateWay. You can ask it to link you to another ham from the "j" list.

I have found it very helpful when I see a "W4??? wants to use the Mailbox/Gateway" message appear on my screen. I know then that if I connect I will probably find someone who is at their keyboard.

It is important to note that this circuit envolves three separate connections. You are connected to your own GateWay station. AX.25 protocol manages everything you attempt to send. Another connection is made between the two GateWay stations. If a retry is needed on hf, they take care of it. And the third connection exists between the distant Gateway and the other packeteer. Retries will occur there only if there are problems at that end.

Besides early afternoon, early morning is a good time to try for a coast to coast packet QSO. If you're willing to get out of bed at 5 or 6 am, the time difference on the east coast may mean you can find someone at their terminal with their morning cup of coffee.

With the growth of packet radio in the last few months, time and space in the radio spectrum has become a scarse commodity. Virtual circuits consume great quanities of both. Because of this, some will condemn the activity.

Careful preparation and good operating practices can minimize the impact on other packet users. I watch the time prompt that WB7DCH provides and try to limit my unsuccessful attempts to 15 minutes. If I can't make a contact after three or four tries, the band conditions on 2Ø meters are not suitable for the long haul link. I disconnect and try again some other time.

Other local packeteers have started using the GateWay for coast to coast QSO's. I have found it almost as much pleasure to watch them chat with distant operators as it is to do it myself. Maybe I will be watching the screen when you make a successful link across the country.

PACKET RAGCHEW
EVERY THURSDAY AT 9 PM
145.33 REPEATER
+++++++
ONE HOUR EARLIER ON
3877.5KHz

TERMINAL SOFTWARE FOR THE C-64
by Peter Dahl, WA7FUS

It seems that all of us are searching for the "ultimate" terminal communications software to use with our computers and TNC's. Recently several such packages for various computers and TNC's have shown up on the market. Each one tries in its own way to answer all or some of our requests for a full featured program. We want large capture buffers. We want to be able to send and receive disk files of various types and sizes. We want to have auto save to disk and many other features such as split screen.

The other day I heard about a program for the Commodore C-64 and TAPR TNC's which had many of the attributes we all have sought in such packages in addition to being available for a reasonable price with profits going to a good cause. I am speaking of the program being marketed to the Texas Packet Radio Society which was described in a recent issue of the ARRL Gateway.

I sent TPRS a check and within a week I had my copy of TNC64. As described in Gateway, TNC64 includes the following features:

1. 50k of capture buffer
2. auto-save to disk if desired
3. up to 3600 a baud rate
4. printer control
5. up-load and down-load facilities for sequential files

TNC64 comes with a clearly written and well printed 18-page manual which tells all one needs to know to begin to use it. The documentation also tells a little bit about the Texas Packet group and invites packeteers to join.

I have just begun to use TNC64 and am, for the most part, very impressed. It is one of the better packages of its kind that I have yet seen. One of my few criticisms of the program is that the writer left two opportunities for the user to dump the program and all of its captured buffer from the computer with a single keystroke. By touching the left arrow key which you might have expected to be a cursor movement key or by touching the run-stop key which is positioned amongst a cluster of commonly used keys one can be kicked out of the program, lose any captured but not yet saved data, and have to reboot the program. Needless to say, I would have preferred that it take a combination of two keys hit simultaneously to reset the computer.

TNC64 is the only communications program that I have ever seen that would run the data flow to and from an external modem and the C-64 faster than 1200 baud. Most will not run reliably at higher than 600 baud. TNC64 runs reliably at an A baud rate of 3600 with TAPR TNC. The text really flies by. Configuring the program to most any baud rate below this speed is very simple. Speeds up to 1200 are simply menu choices and 2400 and 3600 simply require changing a single character in a line of program code.

I don't know how many revisions of the program TPRS plans to make, but in its present state TNC64 certainly is an efficient and very user friendly program which is well worth the investment for packeteers who use a C-64 with a TAPR TNC.

If you would like a copy of TNC64, you can get one by sending a $25 donation to:

Texas Packet Radio Society
P.O. Box 831566
Richardson, TX 75083-1566

Tell 'em NAPRA sent ya!

SPECIAL THANKS TO
AMATEUR RADIO SUPPLY
IN SEATTLE
FOR THE DONATION
OF A CALLBOOK TO NAPRA
IF YOU NEED THE NAME AND ADDRESS
OF A HAM ASK TOM, WB7DCH

PACKET ETIQUETTE

edited by Tom Pace, K7YST

The following excerpts are from "A Primer on How to Work With the USENET Community" by Chuq Von Rospach. USENET is a network of UNIX computer sites dedicated to the exchange of ideas, information and other data. USENET is a large collection of computers that share data with each other. It is the people on these computers that make USENET worth the effort, and for USENET to function properly these people must be able to interact in productive ways. This document is intended as a guide to using the net in ways that will be pleasant and productive for everyone. It makes a lot of sense on packet, as well.

Communication by computer is new to almost everybody, and there are certain aspects that can make it a frustrating experience until you get used to them.

NEVER FORGET THAT THE PERSON ON THE OTHER SIDE IS HUMAN. Because your interaction with the network is through a computer it is easy to forget that there are people "out there." Situations arise where emotions erupt into a verbal free-for-all that can lead to hurt feelings.

Please remember that people all over are reading your words. Do not attack others if you cannot persuade them with your presentation of the facts. Screaming, cursing, and abusing only serves to make people think less of you and be less willing to help you when you need it.

If you are upset at something or someone, wait until you have had a chance to calm down and think about it. A cup of coffee or a good night's sleep works wonders on your perspective. Hasty words create more problems than they solve. Try not to say anything to others you would not say to them in person in a room full of people.

YOUR POSTINGS REFLECT UPON YOU; BE PROUD OF THEM. Most people will know you only by what you say and how well you say it. Take some time to make sure each posting is something that will not embarrass you later. Minimize your spelling errors and make sure that the message is easy to read and understand. Writing is an art and to do it well requires practice. Since much of how people judge you on the LAN is based on your writing, such time is well spent.

BE CAREFUL WITH HUMOR AND SARCASM. Without the voice inflections and body language of personal communications, it is easy for a remark meant to be funny to be misinterpreted. Subtle humor tends to get lost, so take steps to make sure that people realize you are trying to be funny. Hams have used "HI HI" for many many years to help smooth these waters. No matter how broad the humor or satire, it is safer to remind people that you are being funny.

BE CAREFUL ABOUT COPYRIGHTS AND LICENSES. Once something is posted onto the network, it is effectively in the public domain. When posting material to the network, keep in mind that material that is pub- lished under a copyright could cause you to be held liable for damages, so we highly recommend caution in using this material.

CITE APPROPRIATE REFERENCES. If you are using facts to support a cause, state where they came from. Don't take someone else's ideas and use them as your own. You don't want someone pretending that your ideas are theirs; show them the same respect.

SPELLING FLAMES SHOULD BE CONSIDERED HARMFUL. Every few months a plague descends on USENET called the spelling flame. It starts out

(Continued on Page 6)

BOARD

New officers were elected at the October meeting. The following people are now members of The Board of Directors of NAPRA:

President:
WB7DCH Tom Hogan
Executive V. Pres:
WA7FUS Peter Dahl
Technical V. Pres:
KB7DZ Dennis Goodwin
Treasurer:
WB7FHC Budd Churchward
Secretary:
KB7DY Dennis Carpenter
Directors at Large:
KB7G Brett Graham
KD7UW John Hays

PACKET ETIQUETTE

when someone posts an article correcting the spelling or grammar in some article. The immediate result seems to be for everyone on the net to turn into a 6th grade English teacher and pick each other's postings apart for a few weeks. This is not productive and tends to cause people who used to be friends to get angry at each other.

It is important to remember that we all make mistakes, and that there are many users on the LAN who use English as a second language. If you feel that you must make a comment on the quality of a posting, please do so by mail, not on the network.

SUMMARY OF THINGS TO REMEMBER:

Never forget that the person on the other side is human.

Your postings reflect upon you; be proud of them.

Be careful with humor and sarcasm.

Be careful about copyrights and licenses.

Spelling flames should be considered harmful.

PACKET GOES TO COLLEGE

On Wednesday night, October 30, Dennis Goodwin, KB7DZ, and Peter Dahl, WA7FUS, took a packet station to a telecommunications class at Highline Community College. John Marcinko, W7FHZ, was the guest instructor for the class this week and he asked us to help him demonstrate packet as an example of rf digital communication. This was second quarter in a row that we have taken packet to HCC for demo to this course. The demo was received well. Lots of good questions were asked, and for the second time in a row we were able to give successful on the air demonstrations of packet without the intervention of Murphy... must be some sort of a record.

Peter Dahl, WA7FUS

$weepstakes

Last month the editors of COMPUTER TRADER MAGAZINE announced two packet sweepstakes to begin December 1. They listed several prizes for being the first to work all 50 states or 100 countries.

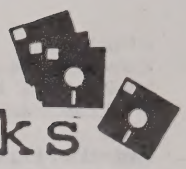
In an eleventh hour decision, CTM has now removed the prize offer saying, "we do not want to commercialize ... ham radio." This announced on a photo copied insert tucked in the issue. (See pages 10 and 11 of Zero Retries).

CTM is to be commended for this move. They demonstrate resposibilty and dedication to packet radio.

The contest will go on! CTM has offered certificates instead. Another contest is being added called "Packet 1000" for those who log 1000 different counties across the U.S.

CTM is a magazine for the "Computerist and Amateur Radio." About 50% of the magazine is dedicated to ham radio, and that being almost exclusively Packet. To subscribe to CTM send $15 (1 year) to CTM, Circulation Manager, 1704 Sam Drive, Birmingham, AL 35235.

DOWNLOADED:



An Introduction to networks

by T.C. McDermott, N5EG
Taken from Computerserve HamNet
Condensed for Zero Retries

Most of us are familiar with packet radio. When we wish to communicate, we ask our TNC to CONNECT to another station. If that station is not within range of our transmitter, then we may connect to that station through a digipeater, or through several digipeaters. This is a convienent extension of the X.25 protocol, and forms a large part of the difference between X.25 and the amateur version called AX.25. Stations operating together under this system form a "Local Area Network," or LAN.

It would be possible to construct a network of stations that are all within range of the next station, and then to connect to any station in the network using this digipeat method, up to 8 stations distant. This would not require the extension of any of the TNC software, nor would it require the development of any new hardware. Why then is this not an acceptable method to construct a network? Basically this method, although simple to implement has a serious flaw, it lacks "robustness". That is, the method fails to support adequate communications in the presence of a radio path that is not perfect. Secondly, it assures communications integrity through a method known as "end-to-end ACK".

To understand this, it is necessary to understand how a digipeater works. Your TNC is a "dumb" digipeater. That is, the digipeater does not understand anything about the state of the two stations that are trying to communicate to each other through it. When one station wishes to connect to another station through a digipeater, it simply adds the digipeater's address in series with the address field of each and every packet. When the digipeater recognizes it's callsign, it repeats the packet. The digipeater does not know what kind of packet is being digipeated, and does not really care, it digipeats them all, blindly. Why is this important? Because it affects how the transmission and acknowledgment of data is handled between the two end stations trying to communicate with each other.

When the sender, S, tries to send data to the receiver, R, through one or more intervening digipeaters, D1, D2, ..., Dn, it does this as follows:

S : sends a packet
D1: digipeats packet
D2: digipeats packet
R : receives packet,
R : sends acknowledge back
D2: digipeats acknowledge
D1: digipeats acknowledge
S : receives acknowledge,
S : sends next packet.

Although there can be several packets sent per acknowledge, it requires that a packet, and the acknowledge (ACK) make the round-trip from the sender to the receiver. Thus, the more digipeaters, the longer the round-trip time, and the lower the packet throughput.

The above example assumed that there were no errors in the transmission. What happens if one of the packets and one of the acknowldeges is corrupted during transmission? The sending station is forced to wait and wait for an ACK until its internal timer times out and it resends the packet again.

How long might this take? Maybe as much as 25 packet times. The situation gets worse when 8 digipeaters are chained together. In fact with 8 digipeaters the round-trip time reduces the channel throughput by a factor of approximately 16 (8 hops to R, and 8 hops for the acknowledge to come back) if there are no channel errors. If the probability that any single transmission is corrupted is about 70%, then with 8 hops the average round trip will take about 1000 packet times. In other words, nothing will get through.

Why is the TNC built this way you might ask? For a very good reason - simplicity. To build a digipeater that behaves in a more coordinated fashion turns out to be a very complicated problem. The digipeater extension is far superior to the other alternative - no digipeater at all. The digipeater is elegantly simple, and a reliable way to improve the communications between two stations that are reasonably close, but not able to communicate directly. We have seen that one or two digipeaters may not degrade the throughput terribly, provided that the RF paths are highly reliable. Thus the digipeater solution may be called a LAN solution. That is, it is an acceptable network for small numbers of digipeaters, and high-quality circuits. A single digipeater in a superior location allows many stations within the coverage area of the digipeater to communicate. But the digipeater is not an acceptable solution when the need is to communicate over long distances, and with less than high-quality communications circuits.

Another method of information transfer possible is "HOP-TO-HOP" acknowledge. In this method, each packet, or small group of packets, is acknowledged by every receiving station along the path from the sender to the receiver. For example, using the same terminology, S=sender, R=receiver, D1,D2, ... Dn = digipeaters.

S : send packet
D1 : ACK to S, rpt frame
D2 : ACK to D1, rpt frame
R : ACK to D2.

Why does this method improve the throughput of the system? Because now that the sender, S does not have to wait for the ACK to return from R, S may send another packet after the ACK from D1. That is, it may OVERLAP traffic.

In other words, once that S has received it's acknowledge, it may transmit the next packet almost immediately (if D1 is on the same channel, it should wait for the D2 --> D1 ack first, if the D2 --> D1 link is on a different frequency [as in a network] then S could transmit the next packet immediately upon receiving the D1 ACK). What happens to the flow of information in the presence of errors in the transmission? Lets look at an example:

S : send packet
D1 : ACK S, repeat packet
D2 : gets garbled packet from D1
D1 : waiting for ACK from D2
D1 : retransmits packet to D2 after time-out

D2 : ACK D1, repeat packet
R : ACK D2

In the first example, it took 25 packet times to accomplish the transfer of one packet from S to R through 2 digipeaters. In this example it took 6 packet times, a 417% performance improvement in the transmission time. This performance improvement actually increases with more digipeaters, or worse RF paths. In fact with 8 digipeaters, and a 70% probability of a sucessful packet-hop, this approach offers about a 10,000% performance advantage!

Additional to the transit time advantage (time delay per packet in seconds-from-S-to-R), there is the advantage in throughput (bytes/sec.). The throughput in the HOP-TO-HOP ack method is NOT dependent upon the number of digipeaters. This is because as soon as the first digipeater has acknowledged the reception of the senders' packet, the sender is free to send the next packet, regardless of the number of hops in the path. Contrast this to the end-to-end hop method, where the throughput is very dramatically dependent upon the number of hops in the path.

What is required of the digipeaters in the network to handle this type of repeating function, i.e. HOP-TO-HOP digipeating? Each repeating station is required to contain a fair amount of memory, enough to buffer every packet that it digipeats until that packet is acknowledged by the next repeater. Since the repeater may receive packets from several different stations at nearly the same time, and perhaps some of them are occaisonally garbled in transmission to the next repeater, then they must be stored in repeater memory until they are sucessfully passed to the next repeater.

The repeaters must also implement some sort of flow control. If packets arrive faster than they can be sent, then the buffer memory could overflow. Thus the repeater must be able to tell the previous repeater, or sender, that the packet is rejected, and to stop sending. When the repeater clears the messages, and thus frees up some memory, then it re-initiates packet transfer from the previous station. This finite memory size limitation actually causes the end-to-end performance of the network to become more heavily dependent upon the quality of the RF links. Thus performance of the HOP-TO-HOP system is dependent upon the probability of RF path-hop success, but is not heavily dependent upon the number of repeaters in the path, unlike the END-TO-END scheme. This was taken into account when I stated that the performance of the HOP-TO-HOP ack with 8 digipeaters, and 70% path-hop probability of success was about 10000% better than the END-TO-END method.

There is one intersting dis-advantage to the HOP-TO-HOP scheme, although it is not a strong disadvantage, and that is the issue of data integrity. In the END-TO-END ack (EEA) scheme when the receiver acquired the data, the ACK was sent. Thus when the sender receives the ACK, there is certainty that the data was in fact received. In the HOP-TO-HOP ack (HHA) all that is known when the sender receives the ack, is that the first digipeater received the ack. A failure in the network could still block the receiver from receiving the data - thus the sender was ACK'ed even though the receiver had not received the data. This is not as serious a problem as it sounds at first, however, since there is still a method to determine whether the data is received at the final destination correctly.

This is handled by layer 4 of the OSI model - the transport layer. It is responsible for data integrity in the real world of unreliable networks. One protocol for doing this is familiar to those of us with AX.25 units, and this is the Virtual Circuit protocol. Each of us is intimately familiar with virtual circuits. Any time that you connect to another station, you have generated a virtual circuit. You and the receiver communicate on a common channel with everybody else. But your traffic only goes to your desired destination, not all destinations on the channel. Thus there is a circuit between you and the connected receiver on a channel with a (theoretically) unlimited number of circuits. This is called a virtual circuit. The only reason there is a circuit is because you and the connected receiver previously agreed to a connection. The circuit is dissolved when you and the receiver agree to this (disconnect).

If communications fails along a path we naturally tend to want a re-transmission of the entire contents of whatever file we may have been sending. If we happened to be in the keyboard mode, then since the communications failed, we cannot continue to send anyway. Thirdly, our TNC's do not tell us how much data they have in their transmit buffers that has not been acknowledged, so the HHA network really doesn't differ from the types of responses that we are used to from the TNC - LAN system.

If we must guarantee the absolute integrity of a file transfer, then we should implement some type of block numbering and sequencing program that controls the file transfer process. In essence, something like the MODEM7 protocol tacked on top of our existing TNC protocol would guarantee the complete integrity of files transfered. We would probably want to add onto the MODEM7 system a little bit, perhaps to record what was and was not sucessfully transfered, and perhaps a method of automatically re-establishing the connection to the other station, and continuing with the transfer process until it is sucessfully completed, and then tearing down the connection.

This additional program that we would run on each of our end-user computers (both sender and receiver) is the LAYER 4 of the OSI model - the transport layer. Since the network we are talking about constructing is thus releived of absolute ACK integrity by the presence of this additional program (in those rare instances where it is really needed) then our netork is only restricted to providing a reasonable guarantee of integrity, perhaps guaranteeing that packets arrive in the correct sequence, and without bit errors. Thus with an emphasis on the HHA VS. the EEA methods, we will need to build a network that optimizes throughput and response, allowing for a layer 4 program in the event it is needed, but not sacrificing the performance of the network for the vast majority of the uses of the network. This trade-off is usually described as a speed-integrity tradeoff in the literature.

Now that a decision has been reached on the desired attributes of the network, that is speed, and simplicity, we may concentrate on one final interface aspect, and that is how the LAN (i.e. the TNC's) are to interface and establish connection through the network. This linkage is the peer communication between two layer 3 processes.

In the 7-layer OSI model, subnet communication (that is communication through a network) is established between two layer 3 processes - that is, the TNC AX.25 mode, and the network entrance and exit layers. Although AX.25 is sometimes discussed as a layer 2

protocol, in the LAN application it is really a layer 3 process. It establishes, communicates, and terminates, and thus it is a layer 3 process. Similarly the network, upon command, will establish, communicate, and terminate, thus it also is performing a layer 3 function.

Why the concern about which layers to call each other? Because it is desirable that the TNC's be able to use the network without any modification. Thus the network must be compatible to the way that the TNC establishes, maintains, and terminates connections, since the network must establish, maintain, and terminate connections to or from TNC's and itself. We are faced with the choices as to how the TNC and the network can talk with one another.

One method of network interface is to assume that the network is transparent, that is it looks like a digipeater. Then you would use your TNC as though the network were a single digipeater (even though it might have many hops, it would appear to the TNC as one digipeater).

Another method is to treat the network as a spearate LAN address. That is, you would connect to the network. Then the network would engage in an interactive session with you regarding the type of service that you needed, that is, who you wanted to talk to, and how to get through the network to that place. Once the network computer was satisfied, it would then engage in comunications between the endpoints. Your TNC would think it was connected to the network, not to your actual destination station.

Each of these connection methods has advantages and disadvantages. We will discuss some of them here.

The digipeater-emulation method is a very natural method to use, because the connection method is familiar to all of the TNC users. Let us establish the following scenario: WDØETZ in Carrollton wishes to communicate with WD5GAZ in Houston. WDØETZ knows that this distance will require the use of the network. So WDØETZ proceeds as follows...

Connect WD5GAZ VIA DALLAS

This seems simple enough, but some interesting problems crop up almost immediately. How does the network know where to find WD5GAZ? What path is required to get there? WDØETZ's TNC is going to want to see ACK's from WD5GAZ, not from DALLAS.

First problems first. One way for the network to know how to find WD5GAZ is for it to keep tables in all of the sites of each and every network user. This is really not practical in an amateur environment because hams move, come, and go, and even change callsigns, and with very many users, it takes a lot of manual intervention to keep the tables current. It also takes a lot of computer power in the network to store and route messages based upon these tables. In the event of a network crash, the tables would have to be reloaded, etc. A simpler way would be for the originator, in this case WDØETZ, to specify the network "hop-off" point, that is, the location in the network where WD5GAZ is likely to be found. For example:

Connect WD5GAZ VIA DALLAS,HOUSTON

Now the network knows that the entry point is this network (which is "DALLAS", the one hearing WDØETZ) and the exit point is HOUSTON. Perhaps different types of names would be chosen for network nodes. Grid-squares and major city names seem to be two obvious choices. What about the route to take to get along the network? There is an incomplete but simple answer to this question - make a linear network (or a simple variant of linear). A linear network is one where the network is basically a straight line. Thus there is by definition only one path between any two points. A few other questions. What if WD5GAZ is not within range of the HOUSTON node, but perhaps within range of a station that is near to the node - for example suppose that WA5AAA is between the HOUSTON node and WD5GAZ. Then...

Connect WD5GAZ VIA DALLAS,HOUSTON,WA5AAA

What if WDØETZ is not within range of the DALLAS node, but is within range of WB5QNG, who is within range of DALLAS?

C WD5GAZ VIA WB5QNG,DALLAS,HOUSTON,WA5AAA

Well, the addressing would work. But the network entry point has to do some strange things to the address field. Remember in the HHA scheme it would be the address DALLAS that is actually ACKing WDØETZ, and not WD5GAZ that would be ACKing WDØETZ, so the network node has to play "fast-and-loose" with the address headers in the digipeat field.

The other method is fairly straight forward. The user connects to the network, and then enters an interactive Q & A session:

Connect DALLAS
Welcome to TEXNET - DALLAS node.
There are currently 4 other users connected to DALLAS.
Enter destination callsign ? (WD5GAZ would be entered here)
Enter network exit node ? (HOUSTON would be entered)
Enter destination digipeaters ? (WA5AAA would be entered)
CONNECTION ESTABLISHED - PROCEED

Notice one thing in the above scenario: more than one station may be connected to the network node entry and exit points. This is something that is a little foreign to the AX.25 protocol, that is MULTIPLE VIRTUAL CHANNELS to a single TNC. In this case it is still compatible with AX.25 since both source and destinations callsigns are part of the AX.25 standard. Only the network nodes have to have this special property of having to be connected to several different stations simultaneously - thus the AX.25 code for these controllers is a little different from a normal implementation. But only the network requires these special TNC's (actually they are built into the node controller, and aren't identifable as a separate device).

The reason that the network should allow for multiple virtual channels is to allow multiple people to simultaneously use the network. Since we will put high-speed radios in the network between nodes, we should take advantage of the bandwidth available.

■■■■■

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CTM PACKET $weepstakes Rules

In an effort to promote packet radio, **CTM** is sponsoring a ham contest like nothing you've ever seen. This contest is open to all licensed amateurs worldwide and boasts a prize list such has never been offered before anywhere!

In actuality, there are two separate contests involved in the **CTM** Packet $weepstakes. The first is what we affectionately refer to as the **CTM Packet 50**, which consists of connecting to all 50 U.S. States. The second is called the **CTM Packet 100**, which involves connecting to 100 or more countries.

The rules are simple. We don't want to play keep away with these prizes, we feel that it's going to be hard enough as it is.

1. All contacts must be made using packet radio on any legal amateur frequency.
2. No store and forward contacts will be allowed. This means that you cannot use a BBS or the store and forward capabilities of PACSAT to make a valid connection. All contacts must be **live** two way communications. Any number of digipeaters or gateways **will** be permitted.
3. All contacts must be made from the same state and country. We wouldn't want somebody traveling to all these places just to get the goodies now, would we?
4. All contacts must be confirmed via standard QSL type cards. All QSL cards must be signed by their operator, and contain the following information:

   Date and time of QSO (preferably in GMT).
   Operator's name, address, city, state, zip code and county.
   Must state that the contact was made using packet radio.
   Manufacturer of Terminal Node Controller used to make the connection (his TNC, not yours).

   In addition, we would like to know the path taken for each contact, although this information is not required.
5. All contacts must take place **after** 0000 GMT on December 1, 1985.
6. Winner will be the earliest postmarked entry received that meets the contest criteria. Keep in mind that the Packet 50 and the Packet 100 are two separate contests.
7. An entry consists of **all** the QSL cards needed to verify your entry (50 or 100 depending on which contest you are working on), along with your own signed QSL card and your telephone number. Send your entry to:
   CTM Packet $weepstakes, Contest Editor, 1704 Sam Drive, Birmingham, AL 35235.

   Please do not send in your entry until you have completed **all** of the requirements for a particular contest. QSL cards will be returned only if you provide an SASE for them. You will be notified when your entry has been verified by our staff.
8. There is no ending deadline for this contest. The contest will continue even after all prizes have been awarded. A handsome certificate that you can be proud of will be awarded to all who submit valid entries. Each month, results of the contest, as we have them, will appear in the contest section of **CTM**.
9. Prizes will be awarded at the next Dayton Hamvention following verification of the entry. In the event that you are unable to attend the Dayton Hamvention, other arrangements will be made.

   At this time, the prize list is still growing.

   As it sits right now, this is way the prizes will be distributed. This prize list will be finalized in the January 1986 issue of **CTM**.

CTM Packet 50

First Prize: ICOM state of the art 2 meter ri… the IC-271H with AC supply)
Second Prize: Heathkit HD… Controller
Third Prize: Kan… ode Controller
Fourth … minal Node Controller
… 64 Commodore 64 Terminal Node … and your choice of software program

PRIZES NO LONGER OFFERED
SEE ANNOUNCEMENT ON NEXT PAGE

CTM Packet 100

First Prize: ICOM state of the … ly the IC-751 dream … amplifier and the IC-AT500…
… onics Terminal Node Controller
… Heathkit HD-4040 Terminal Node Controller

PRIZES NO LONGER OFFERED
SEE ANNOUNCEMENT ON NEXT PAGE

Finally, we would like to make one minor request from all contest participants. Please drop us a line telling us that you are participating in the contest and from time to time drop us another card or letter letting us know how well you're progressing as well as any comments or suggestions that you may have. Please send these cards and letters to the address mentioned above for the entries. As we receive information from you, we will print it here in the contest section for all to see. Good Luck!

Chet Lambert, W4WDR
Editor/Publisher

Jim Griffith, WA5RAX
Packet Editor

Glen Popiel, WA4FTX
Contest Editor

For additional copies of the contest rules, send a self addressed stamped envelope (SASE) to: **CTM** Packet $weepstakes, Contest Editor, 1704 Sam Drive, Birmingham, AL 35235.

See related article on page 6

IMPORTANT ANNOUNCEMENT --- PLEASE READ

When we originally came up with the concept of the **CTM** Packet Sweepstakes, we were as pleased with the concept as many of you were. Many hours of discussion, planning, and thought were put into its design. This work included many hours of discussion of the possible impact such a contest could have on packet radio as well as our whole amateur society. This possible impact could best be summed up by Gwen Reedy, W1BEL, in his column in the October issue of the FADCA>BEACON.

In this article, Gwen says "Leadership and initiative in the packet movement are gradually passing away from the experimenters and organizers and into the hands of the businessmen. As that happens, the special charm that separated packet from the more established ham radio pursuits begins to fade. There is nothing wrong in what is going on, but it is a bit sad. Rather like the passing of the early days of the microcomputer. The charm and excitement are not there any longer; they have been displaced by the sounds of coins."

This was not our intention when we conceived the **CTM** Packet Sweepstakes. We honestly were trying to give packet radio a big shot in the arm. We were totally unaware that we might be giving the patient an overdose. There was no profit or money involved in the contest. Every prize was to be donated and **CTM** was only to serve as a gathering place for the contest participants.

Those of us at **CTM** do not want to commercialize packet or ham radio. All of us, just as so many of you, have spent many hours promoting its growth and educating others to its beauty. The charm that Gwen wrote about should be protected at all costs. It is the one ingredient which will keep our hobby alive. It has been many a year since something like packet radio has come along and provided such a positive impact - such new "life". Therefore, it is with our deepest regrets that we must withdraw all of the prizes that we listed. **The contest, however, will still go on.** In the place of the prizes, we instead will offer beautiful engraved plaques for the first three places in each of the three contests. All who achieve these goals will receive beautiful certificates.

You don't know how much it hurts us to do this to you. We wanted to give these things out just as badly as you probably wanted to win them. However, you must remember that all of us at **CTM** are hams. We believe in the sanctity of ham radio and all that it stands for. It is this spirit that we at **CTM** want to promote and are striving to provide the best possible magazine for packet radio as well as other ham radio and computer activites.

CTM 1704 Sam Drive, Birmingham, AL 35235 (205) 854-0271

NORTHWEST AMATEUR PACKET RADIO ASSOCIATION
MEMBERSHIP APPLICATION FORM

[] RENEWAL [] NEW MEMBER

PLEASE PRINT

NAME : _____

CALL SIGN : _____

MAILING ADDRESS : _____

CITY : _____ STATE : ____ ZIP : _____

PHONE NUMBERS: HOME : (_____) _____ - _____

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PLEASE INDICATE ANY OF THE ABOVE THAT YOU WOULD NOT WANT PUBLISHED IN A MEMBERSHIP ROSTER.

ANNUAL DUES ARE $15.

MAKE CHECK OR MONEY ORDER PAYABLE TO "NAPRA"

SEND TO : NAPRA Sec./Tres. WB7FHC
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OPTIONAL QUESTIONAIRE

1. Packet TNC(s) : _____
2. Computer(s) on packet : _____
3. Band(s) : _____
4. Radio(s) : _____
5. Technical expertise (1 = low, 5 = high) :
   Audio Frequency : _____ Radio Frequency : _____
   Digital Hardware : _____ Digital Software : _____

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